AMENDMENT TO SPECIFICATION

Figure 49 is a right side perspective view showing the drilling alignment fixture of Figure 46 in use to facilitate drilling a pin bore into the base of a die segment of a full-arch dental model cast.

Figures 50A-50L illustrate a prior art 3-D laboratory or clinical dental articulator, and a prior art method of attaching full-arch dental model casts to an articulator, in which:

Figure 50A shows a pair of full-arch dental models casts in a prior art trays and temporarily adhered together by wax in proper occlusion.

Figure 50B is an upper perspective view of a 3-D articulator mechanism and plastic mounting plate adapted to be fastened to the upper or lower surface, respectively, of a support base lower arm or upper arm of the articulator mechanism.

Figure 50C is a lower plan view of the plastic mounting plate of Figure 50B.

Figure 50D is an upper plan view of the plastic mounting plate of Figure 50C.

Figure 50E is a lower perspective view of the plastic mounting plate of Figure 50D, showing semi-liquid die stone adhered to the upper surface of the mounting plate.

Figure 50F is a lower perspective view of the full-arch dental model of Figure 50A, showing a ferromagnetic or magnetized disk being affixed to a lower surface of a prior art molding tray holding ~~a~~ an inverted lower full-arch dental model.

Figure 50G is a view similar to that of Figure 50F, showing a pot magnet magnetically attached to the lower surface of the magnetic disk of Figure 50F.

Figure 50H is a view similar to that of Figure 50G, showing a silicone pin-protection dam being adhered to a lower surface of the molding tray.

Figure 50J is a view showing the mounting base plate of Figures 50C and 50D attached by screw to the lower arch support arm of a 3-D articulator, the lower arch of Figure 50H having had semi-liquid die stone smeared onto the lower surface of the lower arch support tray, pressed into the semi-liquid die stone on the upper surface of the plastic mounting base plate, and allowed to harden.

Figure 50K is a perspective view showing semi-liquid die stone applied to the upper surface of the upper arch support tray and to the lower surface of an upper mounting plate secured to an upper pivotable arm of the articulator preparatory to pivoting the arm downwardly to press the two semi-liquid, die-stone coated surfaces together to cohere and harden.

Figure 50L is a perspective view showing a finished pair of upper and lower full-arch dental model casts properly occluded and removably attached to upper and lower arms of the 3-D articulator.

Figure 51 is a reverse or lower plan view of an articulator slide receptacle according to the present invention.

Figure 52 is a rear end elevation view of the receptacle of Figure 51.

Figure 53 is an obverse or upper plan view of the receptacle of Figure 52.

Figures 53B is a vertical sectional view of the receptacle of Figure 53, taken in the direction of line 53B-53B.

Figure 54A is a perspective view showing a ~~pair of upper and~~ lower full-arch trays ~~holding~~ of a pair of upper and lower dental model castings and the manner of installing the trays on a ~~pair of the~~ receptacles of Figures 51-53.

Figure 54B shows a full-arch tray installed in a tray receptacle of Figures 51-53.

Figure 54~~B~~ C shows the pair of receptacle-mounted trays of Figures 54A and 54B joined in an occlusal relationship by the hinge coupler of Figure 3A.

Figure 55A is a perspective view of a 3-D articulator for use with a method of the present invention.

Figure 55B is a perspective view of a first step in a method according to the present invention of attaching an articulator slide receptacle holding a lower full-arch tray and dental model cast of Figures 54A-54C, to the lower arm of a 3-D articulator.

Figure 56 is a ~~lower~~ perspective view showing a second step for attaching the inverted lower slide receptacle of Figure 55 to the lower articulator arm.

Figure 57 is a lower perspective view showing a third step in attaching the lower slide receptacle to the lower articulator arm.

Figure 58A is a perspective view showing the lower slide receptacle of Figure 57, which has had a magnet magnetically attached to a magnetic disk in the center of the lower surface of the lower slide receptacle. ~~smeared with liquid die stone and pressed into liquid die stone smeared onto the upper surface of a first plastic mounting plate shown in Figure 55, and allowed to harden.~~

Figure 58B is a perspective view showing the upper slide receptacle of Figure 58A, to which a pot magnet has been magnetically attached, ~~preparatory to applying~~ and semi-liquid die stone applied to the upper surface of the slide, and to the lower obverse surface of a second plastic mounting plate attached to the upper pivotable articulator arm preparatory to pivoting the arm downwardly to press the semi-liquid die-stone coated surfaces together to cohere and harden.

A preferred method for removing a master full-arch dental model cast JF from a tray 431A consists essentially of exerting upwardly directed forces on break-away center panels 461 of base wall 442 of the tray which are of sufficient strength to break pins 65 which join the center panels to peripheral ring 460 of the base wall, and then pushing upwardly on that portion of the lower surface MF of a cast JF that is accessible through apertures 469 through the base wall. According to a preferred method of removing cast JF from tray 431A, an anvil template 490 and knock-out tool 491, as shown in Figures 40A, 40B and 41, are employed.

As shown in Figures 40A and 41, template 490 includes a flat base 492 which has an outline shape similar to the plan view shape of a tray 431, but of a larger size. Thus, base 492 of template 490 has in plan view the shape of a semi-ellipse, similar to that of a shoe heel and that of tray 431, but having a semi-major and semi-minor axes each about 3/4 inch larger than those of the semi-elliptically-shaped perimeter of abutment flange walls 455F, 455B of the tray. Base 492 of template 490 has protruding upwardly from a flat upper surface 493 thereof a semi-elliptically curved peripheral flange wall 494 which has a vertically disposed outer wall surface 495 coextensive with the outer perimeter wall surface of the template, and an inner wall surface 496 which is parallel to the outer wall surface and spaced radially inwardly thereof by about 3/8 inch. Peripheral flange wall 494 has a flat upper surface 497 and includes an arcuately curved anterior portion 498 and a straight, transversely disposed posterior end portion 499 which coincides with a minor axis of the semi-elliptically shaped base. Posterior end portion 499 of peripheral flange wall 494 has formed therein a centrally located, rectangularly-shaped notch 500 which protrudes downwardly from upper surface 497 of the flange wall, the notch terminating at upper surface 493 of the template

base. As shown in Figure 41, notch 500 provides clearance for a hinge coupler arm bracket 474 which protrudes rearwardly from a full-arch tray 431.

As shown in Figure 40A, flange wall 494 of full-arch knock-out template 490 also is provided with one or more notches which are spaced circumferentially apart from hinge coupler notch 500, to provide convenient access for receiving a person's thumb or finger to facilitate grasping and removing a tray 431 seated on template 490 as shown in Figure 41. Thus, as shown in Figure 40A, upper surface 497 of flange wall 494 has protruding downwardly therefrom three rectangular cross-section notches, including an anterior notch 501 centered on a major axis of the elliptical template base, and a pair of notches 502A, 502B spaced equidistant from either side of the anterior notch. Preferably, notches 501, 502A and 502B terminate at lower ends thereof in flat surfaces 503, 504A and 504B which are co-planar, parallel to, and spaced above upper surface 493 of template base 492.

As shown in Figure 40A, base 492 of full-arch knock-out template is provided with a pair of arcuately curved, rectangular cross-section ribs 505A, 505B which are spaced transversely apart equidistant from a longitudinal center line of the base coincident with its major axis, and which protrude perpendicularly upwards from upper surface 493 of the base. The outer vertical surfaces 506A, 506B of ribs 505A, 505B are parallel to inner wall surfaces 507A, 507B of flange wall 494, and form therebetween a semi-elliptically curved, sector-shaped channel 507C of a generally constant radial width which is slightly larger than radial span distance between outer surfaces of outer and inner semi-elliptically curved walls 435, 436 of tray 431.

As shown in Figures 40A and 41, template base 492 has a semi-elliptically shaped recess 508 of the proper size and shape to vertically insertably receive in a conformal

loose fit the lower peripheral flange wall 441L which protrudes downwardly from centrally located abutment flange 455 of a full-arch tray 431. Moreover, ribs 505A, 505B protruding upwardly from upper surface 403 of template base 492 are of an appropriate height and location to abut the lower surfaces of break-away center panels 461, or bosses which protrude downwardly from panels which are so constructed, when a tray 431 is placed conformally within the recess 508 in the upper portion of template base 492.

Referring ~~again~~ to Figures 40B and 41, it may be seen that full-arch knock-out tool 491 has a tabular upper portion 509 which has a heel-like planar shape similar to that of knock-out template 490, and four downwardly depending generally square cross-section legs, including a centrally located anterior leg 510, a centrally located posterior leg 511, and a pair of posterior corner legs 512A, 512B transversely aligned with the central posterior leg.

Figure 41 illustrates the manner of using full-arch anvil template 490 and full-arch knock-out tool 491 to remove a full-arch dental model cast JF from tray 431. As shown in Figure 41, tray 431 (See Figure 38) containing cast JF is placed in recess 508 in the upper surface of template base 492, with bottom surfaces ~~372~~ 471 of the break-away base panels 461~~A~~ L, 461~~B~~ R of the tray, or the bottom surfaces 472 of optional bosses ~~370~~ 470 protruding downwardly from break-away base panels 461~~A~~ L, 461~~B~~ R of the tray, supported on upper surfaces 513A, 513B of ribs 505A, 505B. Knock-out tool 491 is then positioned above tray 431, with the lower surface 514 of anterior tool leg 510 resting on the upper surface of the vertex of anterior flange 455, the lower surfaces 515A, 515B of posterior corner legs 512A, 512B contacting upper surfaces of opposite sides of anterior flange 455, and the lower surface 516 of central posterior tool leg 511 contacting the upper surface of a semi-elliptically shaped web section 517 of the tray 431 which is located between inner facing wall surfaces

of the tray and which has upper and lower surfaces 521, 522, which are co-planar with upper and lower surfaces of the abutment flanges, respectively. A sharp blow is then delivered to the flat upper surface 523 of knock-out tool 491, causing the knock-out tool legs to exert downwardly directed forces on tray abutment flange 455 and rear web 517. This force in turn causes the upper surfaces of ribs 505A, 505B to exert upwardly directed forces on break-away center panels 461A, 461B of tray base wall 442, thereby breaking pins 465 which join the center panels to rectangular ring-shaped portion 460 of the base wall, and thence ejecting cast JF upwardly and out from the tray.

Figures 42A, 42B and 43 illustrate the structure and function of a full-arch sawing fixture 520 according to the present invention. As shown in Figures 42A and 42B, full-arch sawing fixture 520 includes a flat base 522 which has in plan view an outline shape and size similar to those of a tray 431. Thus, base 522 of sawing fixture 520 has in plan view the shape of a semi-elliptically shaped plate similar to that of a shoe heel and that of tray 431.

Base 522 of sawing fixture 520 has protruding upwardly from a flat upper surface 523 thereof a relatively thick, semi-elliptical ring-shaped table 524 which has a flat upper surface 525 parallel to upper surface 523 of the base, and a vertically disposed semi-elliptically shaped anterior wall surface 526 which is parallel to and recessed radially inwardly of semi-elliptically curved anterior wall surface 527 of the base, thus forming at a junction therewithin a similarly curved, thin base flange wall 528 which protrudes radially outwardly from the table.

Table 524 of sawing fixture 520 has a flat, vertical posterior transverse end face 529 which coincides with the rear wall surface 530 of base 522 and a minor axis of the elliptical plan view thereof. Also, table 524 has protruding vertically downwardly from upper

surface 525 of the table to upper surface 523 of base 522 a deeply relieved cut-out 531 which has the shape of a semi-elliptical cylinder, the vertically disposed surface of which is parallel to and spaced radially inwardly of outer surface 532 of the table. A lower portion of cut-out 531 is bordered by a thin, short rectangular-shaped end wall 533 which has an upper edge wall 534 located between and parallel to upper wall surface 525 of table 524, and upper surface 523 of base 522.

Referring still to Figure 42, it may be seen that upper surface 525 of table 524 has formed therein a generally radially disposed horizontal saw groove 535 which penetrates inner vertical wall surface 536 and outer vertical wall surface 532 of the table. Saw groove 535 is located approximately midway between rear transverse wall 529 and anterior vertex 538 of table 524, and preferably has a curved, U-shaped transverse section. Sawing fixture 520 also includes a dental model retainer post 539 which protrudes perpendicularly upwards from upper surface 525 of table 524, on a posterior side of groove 535. Retainer post 539 is preferably located near inner vertical wall surface 536 of table 524 rearward of saw groove 535, and may have a square or other suitable cross-sectional shape.

Sawing fixture 520 also includes a thin, vertically disposed arcuately curved dental model retainer flange plate 541 which protrudes perpendicularly upwards from upper surface 525 of table 524. Flange plate 541 protrudes arcuately forward from posterior transverse end face 529 of fixture 520, to a location rearward of anterior vertex 538 of table 524. Also, flange plate 541 has an outer arcuately curved wall surface 543 which is coextensive with outer wall surface 532 of table 524, and an inner curved side surface 545 which is parallel to outer wall surface 543, and a horizontally disposed, arcuately curved upper wall surface 546. Groove 535 penetrates flange plate 541, and inner wall surface 545 of the

flange plate preferably has formed therein alternating vertically disposed ribs and grooves 547, 548, respectively, which are shaped complementary to ribs and grooves formed in a dental model cast by ribs and grooves 449 and 450 of tray 431.

Figure 43 illustrates the manner of using full-arch sawing fixture 520. As shown in Figure 43, a full-arch, upper or lower dental model cast JF is placed downwardly on upper surface 525 of fixture table 524, with the lingual and labial sides of the model adjacent to retainer post 539 and retainer flange plate 541,respectively, with a selected portion of the cast corresponding to a first side of an intended die segment positioned above saw groove 535, whereupon a first of a pair of severing saw cuts is made vertically through the dental model cast by a saw blade S. The two parts of the dental model cast which have been severed from one another are then withdrawn vertically upwards from table 524, moved circumferentially with respect to saw groove 535 to position a second side of the intended die segment above the saw groove, and moved downwardly onto upper surface 525 of the table, between retainer post 539 and retainer flange plate 541, whereupon a second of a pair of saw cuts required to severe a die segment from adjacent portions of the dental model cast is made. In this way, any number of die segments are conveniently severable from dental model cast JF, help to using sawing fixture 520.

It should be noted that interlocking action of ribs 547 and grooves 548 in inner surface 545 of retainer flange plate 541 with complementary shaped grooves and ribs on the base of dental model cast JF help to secure the cast in place on table 524 of sawing fixture 520 as severing saw cuts are made through the cast. Also, it should be noted that the novel asymmetric geometry of full-arch sawing fixture 520 enables any part of a full-arch dental model cast JF to be positioned for segmenting above sawing groove 535, by positioning the

dental model in a forward direction with the anterior portion of the cast facing in the same direction as vertex 538 of table 524 as shown in solid lines in Figure 43, or in a reverse facing direction as indicated by phantom lines in Figure 43.

Figures 44A-44C ~~49~~ illustrate a drilling alignment fixture 550 for full-arch dental model casts according to the present invention. As shown in Figures 44-49, full-arch drilling alignment fixture 550 has a semi-elliptical plan-view shape and includes a semi-elliptically shaped base plate 551 that has a flat bottom surface 552 and a flat upper surface 553 which is parallel to the lower surface. Base plate 551 of drilling alignment fixture 550 has protruding upwardly from flat upper surface 553 thereof a semi-elliptically shaped curved peripheral flange wall 554 which has a vertically disposed outer wall surface 555 coextensive with the outer perimeter wall surface of the fixture, and an inner wall surface 556 which is parallel to the outer wall surface and spaced radially inwardly thereof. Peripheral flange wall 554 has a flat upper surface 557 and includes an arcuately curved anterior portion 558 and a straight, transversely disposed posterior end portion 559 which coincides with a minor axis of the semi-elliptically shaped base. Posterior end portion 559 of peripheral flange wall 554 has formed therein a centrally located, rectangularly-shaped notch 560 which protrudes downwardly from upper surface 557 of the flange wall, the notch terminating at upper surface 553 of base plate 551 of fixture 550. Notch 560 provides a clearance for a hinge coupler arm bracket 474 which protrudes rearwardly from a full-arch tray 431.

As shown in Figures 44, 45 and 48, base plate 551 of full-arch drilling alignment fixture 550 has through its thickness dimension an elongated aperture 561 which has in plan view the shape of a thin, semi-elliptically shaped sector or band which has an outer vertical wall surface 562 which is parallel to and spaced radially inwardly of outer semi-elliptically

curved wall surface 555 of the fixture, and an inner vertical wall surface 563 which is parallel to and spaced radially inwardly of the outer wall surface of the aperture. Semi-elliptical sector-shaped aperture 561 through base plate 551 of drilling alignment fixture 550 serves as a guide track for an elliptically orbitally adjustable drill guide bushing 564, as will now be described.

Referring to Figures 44-48, it may be seen that full-arch drilling alignment fixture includes a thin, flat index arm 565 which has a generally longitudinally elongated rectangular plan view shape, and a symmetrically pointed end 566 which protrudes radially outwardly of curved outer perimeter wall surface 555 of the fixture. Index arm 565 is pivotably mounted parallel to lower wall surface 567 of drilling alignment fixture base plate 551 by means of a screw 568 which has a shank 569 threaded into a bore 570 through the base, at a location near a focus of the semi-elliptically shaped base plate. Shank 569 is disposed vertically through a longitudinally elongated, rectangularly shaped aperture slot 571 provided through the thickness dimension of index arm 565. Slot 571 is located on a longitudinal center line of index arm 565, spaced inwardly of a rear transverse edge wall 572 of the index arm. Index arm 565 is retained parallel to and pivotably movable with respect to lower surface 567 of drilling fixture base plate 551 by a washer 573 positioned on shank 569 of screw 568, below the slotted head 574 of the screw.

Referring to Figures 44, 45, and 48, it may be seen that drill guide bushing 564 has a generally cylindrical shape including a lower cylindrical portion 575 which is fastened within a bore 576 provided through index arm 565, radially inwardly from pointed end 566 of the index arm. Drill bit guide bushing 564 also has an annular ring-shaped flange 577 which protrudes radially outwardly from cylindrical body 578 of the bushing, at a longitudinal location

between lower end wall 579 and upper end wall 580 of the bushing. Flange 577 has a lower face which is slidable on upper surface 553 of drilling alignment fixture 550. Thus constructed, index arm 565 is pivotable about the axis of screw 568 to pointed end 566 of the index arm in vertical alignment with any selected circumferential location around the periphery of fixture base plate 551. Referring to Figure 46, it may be seen that index arm 565 is optionally and preferably fitted with a pointer index pin or gnomon 583 which protrudes perpendicularly upwards from index arm 565, near tip 566 thereof.

As shown in Figure 45, upstanding peripheral flange wall 554 of full-arch drilling alignment fixture 550 forms with base plate 551 a semi-elliptically shaped cylindrical cavity 584 which is of the proper size and shape to vertically insertably receive in a conformal fit the lower ring-shaped peripheral wall 441L which protrudes downwardly from centrally located abutment flange 455 of a full-arch tray 431.

Figure 49 illustrates the manner of using full-arch drilling alignment fixture 550. As shown in Figure 49, a full-arch tray 431 containing a full-arch cast JF from which one or more die segments U have been severed from remaining portions of the cast inserted downwardly into cavity 584 of drilling alignment fixture 550, the bottom surface 434 of the tray resting on upper surface 553 of the drilling alignment fixture base plate. Then, index arm 565 is grasped and pivoted orbitally about the axis of pivot screw shank 569 to position tip 566 and gnomon 583 of the index arm in circumferential alignment with a die segment U which is to have a pin bore drilled into the base thereof for receiving a manipulating pin. Fixture 550 and tray 530 are then inverted, and a drill bit or dental burr B is inserted upwardly into bore 590 of drill bit guide bushing 564, into contact with lower surface N of a die segment U. Drill bit B is then rotated by an electric drill to form a blind pin bore P which protrudes inwardly into

die segment U from its lower surface. In an alternate method of aligning index arm 565 for drilling a pin bore into a die segment, the die segment is removed from tray 531, and index arm 565 is orbited to a position in which drill bit guide bushing 564 is visually centered below a segment of tray aperture 469 exposed by removal of the die segment. The die segment is then re-inserted into the tray cavity, fixture 550 containing tray 531 is inverted, and a pin bore drilled in the base of the die segment in the manner described above.

Figures 50A-50L illustrates a heavy-duty, 3-D articulator mechanism 600 of a type used in dental laboratories and clinics, and a prior art method of attaching a pair of full-arch dental model casts JF to the articulator mechanism. The 3-D articulator is used for checking proper occlusions of the biting contact areas of dental prostheses fabricated in the laboratory and which are to be used for reconstruction or replacement of one or more defective or missing teeth modeled by the casts.

As shown in Figures 50A-50L, a typical prior art method of attaching a pair of full-arch lower and upper dental model casts JFA, JFB to lower arm 601 and upper arm 602 of articulator 600 includes, as shown in Figure 50A, a first step which includes positioning the arches in proper occlusal relationship to one another and temporarily fastening the arches together in that relationship by applying blobs of hot wax U to several contacting regions of the arches, and allowing the wax to cool and harden.

A second step in a prior art method of attaching arches JFA, JFB to articulator 600 consists of attaching a plastic mounting plate 603 to lower arm 601. As shown in Figures 50C, 50D, mounting plate 603 has a flat upper surface 604 which has protruding upwardly therefrom a plurality of intersecting ribs and grooves 604A, 604B arranged in a rectangular grid, and a parallel lower surface 605 into which perpendicularly protrudes a flush-mounted

internally threaded bushing 606 and a pair of longitudinally aligned front and rear blind locating bores 607F, 607B located on opposite sides of the bushing. Mounting plate 603 is removably attachable to lower arm 601 of articulator 600 by means of a thumbscrew 608 which has a threaded shank 609 that protrudes upwardly through a hole 610 through the lower articulator arm, and which is threadably tightenable into bushing 606 of plate 603. As shown in Figure 50B, thumbscrew hole 610 is generally centrally located in lower articulator arm 601, and arm 601 has protruding upwards from upper surface 611 thereof a pair of longitudinally aligned front and rear locating pins 612F, 612B which are adapted to be insertably received in blind locating bores 607F, 607B, respectively, of plastic mounting plate 603, thus securing the mounting plate in a pre-determined, irrotatable position on upper surface 611 of the articulator arm, when thumbscrew 608 is tightened into threaded bushing 606.

As shown in Figure 50F, a third step in attaching a lower full-arch dental model cast to lower articulator arm 601 consists of applying a relatively thick layer of semi-liquid, viscous liquid die stone to the upper surface of mounting plate 603.

A fourth step in fastening a lower full-arch dental model cast JFA to lower articulator arm 601 consists of applying a layer of viscous semi-liquid die stone to a lower surface of a tray T holding the cast. If it is desired to provide a capability for repeatedly removing and replacing the arch from the articulator, a flat disk D made of a magnetized or unmagnetized ferromagnetic material is attached to the lower surface of tray T, as shown in Figure 50F. A pot magnet M is then magnetically attached to an outer surface of magnetic disk D, as shown in Figure 50G. Next, as shown in Figure 50H, a strip of non-adhesive material such as silicone putty SP is secured to the lower surface of tray T, forming an

arcuately curved shield or dam which covers pin bores PB provided through the tray for receiving die-manipulating pins, thereby preventing liquid die stone from entering the pin bores. As shown in Figure 50J, plastic mounting plate 603 is attached to lower articulator arm 601. Liquid die stone is then applied in a thick layer over the entire lower surface of tray T, the tray is inverted, pressing liquid die stone thereof into semi-liquid die stone applied to the upper surface of base plate 603, whereupon the two die stone layers cohere and, time is allowed for the cohered die stone layers to harden into a unitary mass, as shown in Figure 50J.

The steps described above for attaching a lower full-arch dental model cast JFA to lower articulator arm 601, including a last step depicted in Figure 50K, are repeated to attach upper full-arch dental model cast JFB to upper articulator arm 602, thus making a complete articulated dental model as shown in Figure 50L. By employing magnetic means for attaching trays T to mounting plates 603, as described above, upper and lower arches JFA, JFB may be separately removed from 3-D articulator 600 for performing laboratory processing operations on the dental models, and replaced on the articulator in a repeatable occlusal relationship. The dental models are finally removed from the articulator for transporting to the dentist upon completion of laboratory processing of the dental models and prostheses made therefrom. The prior art method and apparatus described above affords no means, absent an expensive duplicate 3-D articulator apparatus in the dentist's office, for positioning a pair of full-arch dental models into a proper occluding relationship for inspection by the dentist and/or patient.

Figures 51-54 illustrate the structure and function of a novel full-arch dental model slide receptacle 620 according to the present invention. As will be described in detail

following a description of the construction of slide receptacle 620, the slide receptacles enable full-arch dental model casts contained in trays 431 to be replaceably removed from a laboratory articulator, whereupon the models may be returned to the dentist and attached to a lighter duty, less expensive, disposable articulator hinge mechanism 32 to comprise an articulated pair of upper and lower full-arch dental models for viewing by a dentist and his or her patient.

As shown in Figures 51 and 53, slide receptacle 620 for use with full-arch dental modeling trays 431 includes a semi-elliptically shaped base plate 621 which has a flat upper surface 622, a flat lower surface 623 parallel to the upper surface, an arcuately curved, vertical anterior wall surface 624, and a straight, transversely disposed posterior vertical wall surface 625 which coincides with a minor axis of the semi-elliptically shaped base. As shown in Figure 51, base plate 621 has formed in flat lower surface 623 thereof a generally centrally located circular blind bore 626 in which is held a flat circular disk 627. Disk 627 is made of a ferromagnetic material such as iron or nickel, and has a flat lower surface 628 which is co-planar, i.e., flush with lower surface 623 of base plate 621.

Referring still to Figure 51, it may be seen that base plate 621has protruding downwardly from lower surface 623 thereof a plurality of locating or indexing members 629, which are spaced radially outwardly from disk 627, and spaced circumferentially apart from each other. Although the precise number, spacing and shape of indexing members 629 is not critical, the embodiment of slide receptacle 620 shown in Figure 51 includes three radially elongated, generally rectangular plan view ribs 629A, 629B, 629C which have generally triangular cross-sectional shapes modified by curved vertices 630A, 630B, 630C. Ribs 629A, 629B, 629C are spaced apart at approximate 120-degree angles and equidistant from the

center of disk 627, which is approximately centered on a focus of semi-elliptically shaped base plate 621. Ribs 629 radiate from the center of disk 627, and as shown in Figure 52, protrude perpendicularly downwards from lower surface 623 of base plate 621 and have lower surfaces 631 disposed parallel to lower plate surface 623. The function of ribs 629 is described below.

Referring now to Figures 52 and 53, it may be seen that full-arch slide receptacle 620 includes a flange wall 632 which has in plan-view the shape of a semi-elliptical sector that protrudes perpendicularly upwards from upper surface 622 of semi-elliptically shaped base plate 621 of the receptacle. Flange wall 632 has an arcuately curved, outer vertical anterior wall surface 633 which is perpendicularly aligned with arcuately curved anterior wall surface 624 of base plate 621, and has at posterior ends thereof a pair of opposed transversely aligned vertical end walls 634A, 634B, which are parallel to and offset a short distance forward from transversely disposed posterior vertical wall surface 625 of the base plate. Arcuately curved anterior flange wall 632 has protruding perpendicularly inwardly from a curved inner wall surface 635 on the flange wall which is parallel to its outer anterior wall surface 633 a radially inwardly turned lip 636 which has a flat upper surface 637. As shown in the figures, lip 636 has the shape of a semi-elliptical sector which has an outer arcuately curved perimeter coextensive with that of curved outer surface 633 of flange wall 632, and an inner perimeter wall 638 spaced radially inwardly from inner wall surface 635 of the flange wall. Also, as shown in Figure 53, lip 636 has formed in rear transversely aligned and opposed ends 637A, 637B thereof proximate rear end walls 634A, 634B of flange wall 632 a pair of opposed forward protruding cut-outs or notches 638A, 638B. As is also shown in Figure 53, rear end portions 639A, 639B of upstanding flange wall 632 have formed in

upper halves thereof transversely inwardly disposed, opposed, arcuately curved club-shaped retainer enlargements 640A, 640B.

Semi-elliptically curved flange wall 632, and radially inwardly disposed lip 636 which protrudes perpendicularly inwards from the flange wall have inner adjacent vertical and horizontal surfaces 641, 642, respectively, which together with upper surface 622 of receptacle base plate 621 form a semi-elliptically curved channel 643 that is of the proper size and shape to slidably receive semi-elliptically curved lower base surface 434 of a full-arch tray 431. Thus, as shown in Figure 54, to removably install a tray 431 in receptacle 620, base surface 434 of a full-arch tray 431 is placed on upper surface 622 of the receptacle and slid forward on that surface, into channel 643, the upper surface of anterior abutment flange 455 sliding forward on lower surface 644 of lip 636. Tray 431 is slid sufficiently far forward within the channel 643 for vertex 455V of anterior abutment flange 455A to abut the vertex 645 of inner vertical surface 646 of vertical flange wall 642. Thus positioned, opposed transverse corners of rear abutment flange 455B of tray 432 frictionally wedge between retainer enlargements 640A, 640B, respectively, of flange wall 632, thus retaining tray 431 securely fixed within channel 643 of slide receptacle 620.

Figures 54-62 illustrate the manner of using full-arch tray slide receptacle 620. As shown in Figure 54A, 54B, a pair of lower and upper full-arch dental model trays 431A, 431B containing lower and upper dental model casts JFA, JFB, and joined by an articulator hinge mechanism 32 are slidably mounted in a pair of lower and upper slide receptacles 620A, 620B, in the manner described above. Next, as shown in Figures 56A, 56B, a relatively thick layer of viscous semi-liquid die stone is applied to the upper surface 604 of a first, lower arch mounting base plate 603, and the base plate is attached to lower arm 601 of articulator

600 by means of a lower arm thumbscrew 608A. Then, as shown in Figure 57, a pot magnet PM is magnetically attached to disk 627 of lower slide receptacle 620A. Following this step, as shown in Figures 57A and 57B, a relatively thick layer of semi-liquid die stone is applied over pot magnet PM and the lower surface of inverted slide receptacle base plate 621. Lower slide receptacle 620A containing lower full-arch tray 431A and dental model cast JFA is then uprighted, and the semi-liquid die stone layer on the lower surface of the slide receptacle pressed into the semi-liquid die stone layer on the upper surface of lower mounting base plate 603. Time is then allowed for the two die stone layers to cohere and harden into a unitary mass.

As shown in Figures 58 and 59, the steps described above for attaching a lower full-arch dental model cast JFA contained in tray 431A temporarily slidably mounted in a first lower slide receptacle 620A are repeated to attach a second, upper slide receptacle 620B holding an upper full-arch tray 431B and upper full-arch dental model cast JFB to upper articulator arm 602, thus making a complete articulated dental model as shown in Figure 59.

By employing magnetic attachment means for mounting lower and upper full-arch slide receptacles 620A, 620B to lower and upper articulator arms 601, 602, the slide receptacles may be separately and repeatedly removed from 3-D articulator 600 to enable various laboratory processing operations required for the manufacture of dental prostheses to be performed on dental model casts JFA, JFB, and the slide receptacles re-attached to the articulator arms in precisely pre-determined positions which provide proper occlusal relationship between the models. Moreover, upon completion of laboratory processing of dental models and prostheses made therefrom using full-arch slide receptacles 620 according

to the present invention, slide receptacles 620A, 620B containing lower and upper full-arch trays 431A, 431B and dental models JFA, JFB can be quickly and easily removed from the articulator, as shown in Figure 60, and the trays quickly and easily slidably removed from the slide receptacles, as shown in Figure 61. The trays 431A, 431B containing the full-arch lower and upper dental model casts JFB, JFB can then be returned to the dentist's office where they are readily connectable by a low-cost articulator hinge mechanism 32 to form an articulated full-mouth dental model which has a proper occlusal relationship of sufficient precision, for inspection by the dentist and viewing by his or her patient, as shown in Figure 61.

Figures 62-65 illustrate the structure and function of an insert 650 for use with a full-arch modeling tray 431 according to the present invention. As shown in Figures 62-65, insert 650 has a flat, longitudinally elongated, semi-elliptical arch-shaped plan-view base plate 651. As shown in Figures 62 and 63, base plate 651 of insert 650 has a generally uniform thickness, and has flat and parallel lower and upper surfaces 652, 653, respectively. Referring to Figure 62, insert 650 may be seen to include a pair of longitudinally elongated, quarter-elliptically-shaped plan view bosses 654L, 654R, which protrude upwardly from upper surface 653 of insert base plate 651, the bosses being concentrically located with respect to convex outer, inner and concave inner and left and right rear transverse perimeter wall surfaces 655, 656, 657 and 658, respectively, of the base plate. As shown in Figure 62, bosses 654L, 654R of insert 650 have generally vertically disposed outer convex and inner concave side walls 659, 660, and front and rear transverse side walls ~~651, 652~~ 661,662, which are inclined towards a vertical, longitudinally disposed mid plane of the boss.

Referring now to Figures 63-65, it may be seen that insert ~~660~~ 650, constructed as described above, is adapted to be fitted into lower well 463 of tray 431, with bosses 654L, 654R fitting conformally within apertures 469L, 469R through base wall 442 of the tray. Thus positioned, upper surfaces 672L, 672R are substantially flush with upper surface 459 of base wall 442 of tray 431.